

# Patient-Reported Outcomes following Arthroscopic Triangular Fibrocartilage Complex Repair

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## Abstract

**Background** Triangular fibrocartilage complex (TFCC) injury is a common cause of ulnar-sided wrist pain, which may lead to serious physical impairments. Arthroscopic repair has benefits such as less soft tissue damage, greater surgical accuracy, and may lead to faster recovery than open repair.

**Objective** The purpose of this study was to determine the functional outcome of patients with symptomatic TFCC injuries treated with arthroscopic debridement or repair.

**Patients and Methods** A retrospective study of all consecutive patients with a TFCC injury treated arthroscopically was conducted. The primary outcome was the patient-rated wrist evaluation (PRWE) score. Secondary outcomes were, pain, operative findings, complications, and additional treatment.

**Results** A total of 51 patients with a median follow-up of 16.5 months (interquartile range [IQR]: 13–25) were included. Injuries were treated with TFCC debridement ( $n = 25$ ), TFCC ligament to capsule suturing ( $n = 10$ ), TFCC debridement and ligament to capsule suturing ( $n = 7$ ), TFCC debridement and synovectomy ( $n = 5$ ), and TFCC foveal reinsertion with a suture anchor ( $n = 4$ ). The median PRWE was 19.5 (IQR: 6–49). Complications occurred in three patients and in nine patients additional surgery was performed.

**Conclusion** Arthroscopic treatment of TFCC lesions leads to satisfactory functional outcomes.

**Level of Evidence** This is a Level IV study.

## Keywords

- ▶ TFCC
- ▶ arthroscopy
- ▶ repair
- ▶ debridement
- ▶ PRWE

Triangular fibrocartilage complex (TFCC) injury is a common cause of ulnar-sided wrist pain, which may lead to serious physical impairments.<sup>1</sup> Since Palmer first described and categorized TFCC injuries in 1981, many different surgical techniques have been described to treat these injuries.<sup>2,3</sup>

Open repair of TFCC injuries was one of the first described operations.<sup>4</sup> In more recent studies, arthroscopic TFCC repair has shown to have comparable outcomes compared with open repair.<sup>5</sup> Ulnar peripheral lesions of the TFCC can be treated

with arthroscopic ligament to capsule suturing.<sup>6,7</sup> TFCC foveal loosening can be repaired with arthroscopic fixation with a suture anchor whereas central lesions are usually treated by arthroscopic debridement.<sup>3,8</sup> Arthroscopic repair has benefits such as less soft tissue damage, greater surgical accuracy, and may lead to faster recovery than open repair.<sup>9,10</sup>

Few studies have described the functional outcomes, measured with patient rated outcome measures, of patients following arthroscopic treatment of TFCC injuries.<sup>8,11</sup> These

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studies are usually pertaining to a specific type of arthroscopic technique or specific type of lesion. Therefore, the aim of this study was to determine the functional outcome of patients with symptomatic TFCC injuries treated with arthroscopic debridement or suture repair.

## Patients and Methods

In this single center retrospective cohort study all consecutive patients with a TFCC injury treated arthroscopically in a single hospital between March 2015 and January 2018 were reviewed. All surgeries were performed by a single surgeon with an experience level V according to Tang.<sup>12</sup>

All patients with arthroscopically confirmed and treated TFCC injuries were included. Minimum follow-up was 6 months and was determined as the time between the arthroscopy and completion of the patient related outcome.

The primary outcome was the patient-rated wrist evaluation (PRWE) score. The PRWE is a 15-item questionnaire that measures wrist pain and disability in activities of daily living. The highest score, indicating severe impairment, is 100 and the best score, indicating no impairment, is zero.<sup>13</sup> Secondary outcomes were, pain as indicated on the visual analogue scale (VAS), operative findings, complications, and additional treatment.

Patient characteristics were collected using the clinical records. All patients were contacted by phone and asked to complete the PRWE questionnaire and to verify patient characteristics missing from their medical record. Types of arthroscopic interventions performed were debridement of central TFCC tears with or without additional synovectomy, ligament to capsule suture repair or TFCC reinsertion in the fovea with a suture anchor. Occupation was categorized by type: desk-based, manual labor, domestic, retired, unemployed or unknown. Students were grouped under desk-based occupation as well.

## Classification of TFCC Tears

Palmer classified TFCC injuries.<sup>14</sup> This classification categorizes TFCC lesions as traumatic (type 1) or degenerative (type 2). Traumatic lesions are classified according to the location of the injury (→ **Table 1**). Degenerative lesions are classified according to the extent of degeneration.<sup>14</sup>

The “iceberg concept” according to Atzei presents a visual representation of the TFCC. The tip of the iceberg represents the TFCC part that functions as the shock absorber. The two base points represent the foveal insertion of the TFCC functioning as the stabilizer of the DRUJ (distal radioulnar joint) and the ulnar carpus.<sup>15</sup> An intact TFCC is soft and compliant, producing a “trampoline effect” when pressure is applied with a probe; this indicates a positive trampoline test.<sup>1</sup> This effect is gone when there is a peripheral TFCC tear. The hook test is performed by applying traction with the probe onto the free edge of the TFCC.<sup>6</sup> The test is considered positive when the TFCC can be lifted from the foveal area toward the center of the radiocarpal joint, indicating a proximal TFCC tear and thus foveal loosening. Both trampoline and hook test are considered reliable in diagnosing and classifying peripheral TFCC tears.

**Table 1** Palmer classification for TFCC acute and degenerative traumatic tears

Type lesion	Description
Type 1	Acute traumatic tear
1A	Central perforation
1B	Ulnar avulsion with or without distal ulnar fracture
1C	Distal avulsion
1D	Radial avulsion with or without sigmoid notch fracture
Type 2	Degenerative
2A	TFCC wear
2B	TFCC wear with lunate and/or ulnar chondromalacia
2C	TFCC perforation with lunate and/or ulnar chondromalacia
2D	TFCC perforation with lunate and/or ulnar chondromalacia with lunotriquetral ligament perforation
2E	TFCC perforation with lunate and/or ulnar chondromalacia with lunotriquetral ligament perforation and ulnocarpal/radioulnar arthritis

Abbreviation: TFCC, triangular fibrocartilage complex.

## Operative Technique

During wrist arthroscopy the forearm was in an upright and neutral position and was held in an arc wrist tower (Acumed, Hampshire, United Kingdom). The elbow was flexed at 90 degrees and axial traction of 4 kg was applied. Four portal entries were created by superficial stab incisions and blunt preparation through the joint capsule; the 3-4, 6-R one midcarpal radial and one midcarpal ulnar portal. The 3-4 portal was used for visualization and the 6-R portal for instrumentation. With the 1 mm hook probe assessment of the TFCC was performed. Type 1A, 2A, 2B, 2C, and 2D TFCC injuries were treated with debridement of the TFCC lesion and an additional synovectomy with a small duckbill or shaver.

Type 1B injuries were treated with either a simple ligament to capsule suture or a reinsertion of the TFCC at the fovea with a suture anchor (Mitek Mini QUICKANCHOR, DePuy Synthes Companies, Zuchwil, Switzerland) when the hook test was considered positive. The fovea was identified through a direct fovea incision just volar of the distal ulna. Next the fovea was debrided with a small rongeur. A Mitek anchor was inserted. At this stage both the sutures of the anchor were on the outside. The ends of the sutures were positioned in a needle, one by one and aimed through the TFCC inside the joint. Subsequently, both suture ends were brought outside through the 6R portal and were tightened in that manner that the knot was positioned inside on the TFCC.

Postoperatively, all patients had an above the elbow cast for 4 weeks followed by 2 weeks a short arm cast. Patients with a grossly unstable distal radioulnar joints were not treated arthroscopically but scheduled for open repair. The

elbow was positioned in 90 degrees of flexion. The examiner fixed the radius with one hand. With the other hand the distal ulna was pushed volarly and dorsally with the wrist in neutral position. When the distal ulna balotted out of the sigmoid notch during balottement test, it was defined as grossly unstable. All patients were offered hand therapy postoperatively.

### Statistical Analysis

General descriptive statistics on patient characteristics at baseline were performed including factors such as gender and age and presented as percentages (categorical variables), means and standard deviation (continuous variables, normally distributed) or median and interquartile range (continuous variables, not normally distributed), whichever applicable.

The difference in PRWE scores between groups was analyzed with the Mann-Whitney U test (not normally distributed data). Values of  $p < 0.05$  were considered significant.

### Results

A total of 51 patients with a median follow-up of 16.5 months (IQR 13–25) were included in this cohort study, of which 12 patients had a follow-up of 24 months or more. The median age was 33 years (IQR 21–45) and 51% were females. Patients were seen after visiting our Emergency Room ( $n = 24$ ), referred by other specialists ( $n = 23$ ) or by the general practitioner ( $n = 4$ ). All patients presented with wrist pain, of which 41 had specific ulnar-sided wrist pain and a positive fovea sign. Forty-five patients had a previous trauma of the wrist, of which 10 had a concomitant fracture of the distal radius. Preoperative MRI imaging was performed in 24 patients, of which 12 showed a TFCC tear (►Table 2). Patient characteristics are displayed in ►Table 3.

A total of 39 patients suffered traumatic TFCC injuries and 12 patients had a degenerative TFCC injury (►Table 4). The 22 patients with 1B lesions when classified according to Atzei were 11 class 1 lesions, 6 class 2 lesions, and 5 class 3 lesions. Additional SL (scapholunate) lesions were found in 10 patients and additional LT lesions in 8 patients. Classification of the lesions is presented in ►Table 5.

Out of the 51 patients invited to complete the PRWE questionnaire, 44 patients responded. The median PRWE was 19.5 (IQR 6–49). Median VAS at follow-up was 0 (IQR 0–2).

Injuries were treated with TFCC debridement ( $n = 25$ ), TFCC ligament to capsule suturing ( $n = 10$ ), TFCC debridement and ligament to capsule suturing ( $n = 7$ ), TFCC debridement and synovectomy ( $n = 5$ ), and TFCC foveal reinsertion with a suture

**Table 2** MRI conclusion vs. arthroscopic findings

Arthroscopic finding	MRI conclusion		
	TFCC tear	No TFCC tear	Inconclusive
TFCC tear	12	10	2

Abbreviations: MRI, magnetic resonance imaging; TFCC, triangular fibrocartilage complex.

**Table 3** Patient characteristics ( $n = 51$ )

	Number
Gender	
Male	26
Female	25
Age, median (IQR)	33 (21–45)
Dominant hand affected	23
Occupation	
Manual labor	26
Desk labor	17
Unemployed	6
Domestic	1
Missing	1
Previous trauma	45
With distal radius fracture	10

Abbreviation: IQR, interquartile range.

**Table 4** TFCC classification of patients ( $n = 51$ )

TFCC	Number
1A	13
1B	22
1C	1
1A + 1B	1
1A + 1C	1
1B + 1C	1
2A	4
2B	3
2C	4
2D	1

Abbreviation: TFCC, triangular fibrocartilage complex.

**Table 5** Geissler classification of additional lesions

	Number
SL lesions	
None	39
Grade 1	1
Grade 2	4
Grade 3	6
Grade 4	1
LT lesions	
None	43
Grade 1	4
Grade 2	1
Grade 3	1
Grade 4	2

Abbreviations: LT, lunotriquetral; SL, scapholunate.

anchor ( $n=4$ ). Median PRWE did not differ significantly between patients treated for Palmer type A lesions (17 [IQR 6–49]) and Palmer type B lesions (23 [IQR 3–50];  $p=0.9$ ). There was also no significant difference in median PRWE scores between type 1 and type 2 Palmer lesions (21 [8–51] vs. 12 [2–43],  $p=0.30$ ).

Three patients had pain due to the polydioxanone suture. After removal of the suture knot these complaints disappeared. No other complications were found.

In nine patients additional surgery was performed. These nine patients had a median PRWE score of 51 (7–80). An ulna shortening osteotomy was performed in three patients. These were all patients with Palmer 2C lesions in which debridement of the central TFCC perforation provided insufficient pain relief. Two patients had an additional arthroscopy, one for an additional debridement of the same TFCC lesion, and another for a new 1B TFCC lesion. Due to persistent pain caused by midcarpal and radiocarpal osteoarthritis a wrist denervation was performed in two patients. One patient with a 1B lesion had an open repair 6 months after arthroscopic ligament to capsule suturing of the lesion. One patient had a proximal row carpectomy followed by a radioscapulohumeral arthrodesis due to complaints caused by osteoarthritis in the 1 year following initial arthroscopy.

Patients who had additional procedures performed had clinically worse PRWE scores, a median of 51 (IQR 7–80) versus a median of 19 (IQR 5–43), but this difference was not statistically different ( $p=0.18$ ).

## Discussion

The results of this study show that arthroscopic treatment of TFCC lesions leads to satisfactory functional outcomes. The median PRWE after 16.5 months follow-up was 19.5.

It must also be taken into account that arthroscopic treatment of a TFCC lesion may not always provide sufficient results. Our study showed that nine patients (18%) needed additional treatment such as ulnar shortening osteotomies, additional arthroscopy, or open TFCC repair. These findings are similar to the additional surgical procedures in 17 to 29% of cases reported in the literature.<sup>16,17</sup>

Magnetic resonance imaging (MRI) is frequently used to detect TFCC tears.<sup>18</sup> The wide variety in quality of MRI and interpretation of MRI results in a range of sensitivity from 0.76 to 1.0 and specificity from 0.41 to 1.0.<sup>19</sup> MRI was performed in half of our patients. MRI, in this series, was only able to detect a TFCC in half of the patients with an arthroscopically confirmed TFCC lesion. Persistent ulnar-sided wrist pain, without abnormalities on MRI, may therefore not always exclude a TFCC lesion.

There are several limitations to this study. Due to its retrospective nature, no presurgical data were available to compare the functional outcomes with the postoperative ones. Despite the usually detailed medical records, more subtle complications such as sensory nerve damage may not have been documented. Functional outcomes were, however, collected prospectively. Furthermore, patients with all types of TFCC lesions were assessed in this study resulting in a

heterogeneous group. The results, however, do provide a general overview of the functional outcomes of arthroscopic treatment and no difference was found between Palmer type A and type B lesions.

Time to follow-up ranged from 7 to 75 months. All patients did not have the same amount of time to recover and some had additional procedures performed during this time period. Although not statistically different, patients with additional procedures had clinically worse PRWE scores, with a difference of 32 points. The minimal clinical important difference for the PRWE score is 11.5 points.<sup>20</sup> This difference in follow-up affected the range in PRWE score.

The effect of arthroscopic treatment of TFCC lesions, measured with patient-rated outcomes, has been described by several studies. Studies addressing central lesions have shown that arthroscopic debridement efficiently reduces wrist pain and yields mean PRWE scores of 17.<sup>8</sup> Regarding arthroscopic treatment of peripheral tears, PRWE scores ranging from 19 to 33 with a follow-up range of 11.5 to 17.5 months have been reported.<sup>11,21</sup> These PRWE scores described are comparable to our median PRWE of 19.5, concluding that arthroscopic treatment of TFCC lesions leads to acceptable functional outcomes.

### Note

The work was performed in the Maasstad Hospital.

### Funding

None.

### Conflict of Interest

None declared.

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